

1 **Listing of Claims**

- 2 1. (Currently Amended) An apparatus, comprising:
3 a fluidic Micro Electro-Mechanical System (MEMS) ~~that is formed~~
4 ~~including~~comprising a polymer layer ~~and joined to~~ a substrate portion, the polymer
5 layer of the apparatus comprising:
6 a containment portion that in combination with the substrate ~~encloses~~
7 ~~defines~~ a fluidic channel, wherein the containment portion includes a deep
8 cross-linked polymer region and a shallow cross-linked polymer region,
9 and
10 wherein the deep cross-linked polymer region and the shallow cross-
11 linked polymer region of the containment portion are formed as a unitary
12 structure.
- 13 2. (Original) The apparatus of claim 1, further comprising a resistor located in,
14 on, or adjacent to the substrate.
- 15 3. (Original) The apparatus of claim 1, wherein a portion of the containment
16 portion that does not contact the substrate includes a shallow cross-linked polymer
17 region and a portion of the containment portion that contacts the substrate includes
18 a deep cross-linked polymer region.
- 19 4. (Currently Amended) The apparatus of claim 3, wherein portions of the
20 containment portion that includes the shallow cross-linked polymer region are on
21 lateral sides of the fluidic ~~channel~~channel.

1 5. (Original) The apparatus of claim 3, wherein portions of the containment
2 portion that includes the deep cross-linked polymer region are separated by the
3 fluidic channel from the substrate.

4 6. (Original) The apparatus of claim 1, wherein the apparatus acts as a pump.

5
6 7. (Original) The apparatus of claim 1, wherein the apparatus acts as a
7 polymerase chain reaction (PCR) reactor.

8
9 8. (Original) The apparatus of claim 1, wherein the apparatus acts as a
10 separator.

11
12 9. (Original) The apparatus of claim 1, wherein the apparatus acts as an optical
13 waveguide.

14 10. (Original) The apparatus of claim 1, wherein the apparatus acts as a filter.

15
16 11. (Original) The apparatus of claim 1, wherein the deep cross-linked polymer
17 region and the shallow cross-linked polymer region are produced using direct
18 imaging techniques.

19
20 12. (Original) The apparatus of claim 1, wherein the deep cross-linked polymer
21 region and the shallow cross-linked polymer region are produced using lost wax
22 techniques.

1 **13.** (Original) The apparatus of claim 1, wherein the deep cross-linked polymer
2 region and the shallow cross-linked polymer region are produced using dry film
3 techniques.

4 **14.** (Withdrawn) A method of making a fluidic Micro Electro-Mechanical
5 System (MEMS) on a substrate, comprising:

6 depositing a polymer material to form a polymer layer on the substrate; and
7 hardening portions of the polymer layer to create a containment portion
8 from a shallow cross-linked polymer region and a deep cross-linked polymer
9 region, wherein the shallow cross-linked polymer region and the deep cross-linked
10 polymer region of the containment portion are formed as a unitary structure.

11 **15.** (Withdrawn) The method of claim 14, wherein at least a portion of the
12 fluidic MEMS acts as a pump.

13 **16.** (Withdrawn) The method of claim 14, wherein at least a portion of the
14 fluidic MEMS acts as a polymerase chain reaction (PCR) reactor.

15 **17.** (Withdrawn) The method of claim 14, wherein at least a portion of the
16 fluidic MEMS acts as a separator.

17 **18.** (Withdrawn) The method of claim 14, wherein at least a portion of the
18 fluidic MEMS acts as an optical waveguide.

19 **19.** (Withdrawn) The method of claim 14, wherein at least a portion of the
20 fluidic MEMS acts as a filter.

1 **20.** (Withdrawn) The method of claim 14, further comprising locating a
resistor within, of adjacent to, the substrate.

2
3 **21.** (Withdrawn) The method of claim 14, further comprising spinning the
4 deposited polymer material to make the polymer layer more planar.

5
6 **22.** (Withdrawn) The method of claim 14, wherein certain portions of the
7 containment portion are fabricated using a strong exposure cross-linking process,
8 while other portions of the containment portion are fabricated using a weak
exposure cross-linking process.

9
10 **23.** (Withdrawn) The method of claim 14, wherein the method includes direct
11 imaging techniques.

12
13 **24.** (Withdrawn) The method of claim 14, wherein the method includes lost
14 wax techniques.

15
16 **25.** (Withdrawn) The method of claim 14, wherein the method includes dry
17 film techniques.

18
19 **26.** (Withdrawn) A method of making a pump on a substrate, comprising:
20 depositing a polymer material on the substrate to create a polymer layer;
and

21 hardening portions of the polymer layer to create a first check valve, a
22 second check valve, and a containment portion from the polymer material,
23 wherein the first check valve, the second check valve, and the containment portion
24 are formed as a unitary structure.

1 27. (Withdrawn) The method of claim 26, further comprising forming a
2 recessed portion in the substrate that corresponds to each of the first check valve
3 and the second check valve.

4 28. (Withdrawn) The method of claim 26, further comprising spinning the
5 deposited polymer material to make the polymer layer more planar.

6 29. (Withdrawn) The method of claim 26, further comprising creating a
7 resistor in the substrate, for forming a bubble to create a pressure differential.
8

9 30. (Withdrawn) The method of claim 26, wherein the first check valve and the
10 second check valve are created using a strong exposure cross-linking process.
11

12 31. (Withdrawn) The method of claim 26, wherein certain portions of the
13 containment portion are fabricated using a strong exposure process, while other
14 portions of the containment portion are fabricated using a weak exposure cross-
15 linking process.

16 32. (Withdrawn) A pump apparatus formed including a polymer layer and a
17 substrate portion, the polymer layer of the pump apparatus comprising:
18 a first check valve including a deep cross-linked polymer region;
19 a second check valve including a deep cross-linked polymer region;
20 a containment portion that in combination with the substrate encloses a
21 fluidic channel; and
22 wherein the first check valve, the second check valve, and the containment
23 portion are formed in the polymer layer as a unitary structure.
24
25

1 33. (Withdrawn) An integrated total chemical analysis system that is fabricated
on a substrate using a direct imaging process, further comprising:

2 a portion of the deep cross-linked polymer region that defines lateral fluid
3 boundaries of the integrated total chemical analysis system; and

4 a shallow cross-linked polymer region for defining upper fluid boundaries
5 of the integrated total chemical analysis system, wherein the deep cross-linked
6 polymer region and the shallow cross-linked polymer region form a unitary
7 structure.

8 34. (Withdrawn) The integrated total chemical analysis system of claim 33,
9 that includes at least two devices from the group of a filter, a pump, a waveguide,
10 a polymerase chain reaction (PCR) reactor, and a separator.

11
12 35. (Withdrawn) The integrated total chemical analysis system of claim 33,
13 wherein the deep cross-linked polymer region is cross-linked using a strong direct
14 imaging exposure process.

15
16 36. (Withdrawn) The integrated total chemical analysis system of claim 33,
17 wherein the shallow cross-linked polymer region is cross-linked using a weak
18 direct imaging exposure process.

19
20 37. (Withdrawn) The integrated total chemical analysis system of claim 33,
21 wherein the integrated total chemical analysis system includes a fluidic micro
22
23
24
25 electro-mechanical system (MEM) device.

1 **38.** (Withdrawn) A method comprising:

2 fabricating using a single process a fluidic micro electro-mechanical system
3 (MEMS) device on a polymer layer deposited on a substrate, the fabricating the
4 fluidic MEMS device includes:

5 defining lateral fluid boundaries of the fluidic MEMS device using a strong
6 direct imaging exposure process; and

7 defining upper fluid boundaries of the fluidic MEMS device using a weak
8 direct imaging exposure process.

9 **39.** (Withdrawn) The method of claim 38, further comprising filtering fluid
10 with the fluidic MEMS.

11
12 **40.** (Withdrawn) The method of claim 38, further comprising heating fluid
13 with the fluidic MEMS.

14
15 **41.** (Withdrawn) The method of claim 38, further comprising separating fluid
16 with the fluidic MEMS.

17
18 **42.** (Withdrawn) The method of claim 38, further comprising optically
19 detecting material in a fluid using the fluidic MEMS.

20
21 **43.** (Withdrawn) The method of claim 38, further comprising pumping fluid
22 with the fluidic MEMS.

1 **44.** (Withdrawn) A method of making a reactor on a substrate, comprising:
2 forming at least one heating element within, or proximate to, the substrate;
3 depositing a polymer material on the substrate that creates a polymer layer;
4 and

5 hardening portions of the polymer layer to create a containment portion,
6 wherein the containment portion is formed as a unitary structure.

7 **45.** (Withdrawn) The method of claim 44, further comprising spinning the
8 deposited polymer material to make the polymer layer more planar.

9 **46.** (Withdrawn) The method of claim 44, wherein the first check valve and the
10 second check valve are created using a strong exposure cross-linking process.

11 **47.** (Withdrawn) The method of claim 44, wherein certain portions of the
12 polymer layer are fabricated using a strong exposure process, while other portions
13 of the polymer layer are fabricated using a weak exposure cross-linking process.

14 **48.** (Withdrawn) A reactor apparatus formed including a polymer layer portion
15 and a substrate portion, the polymer layer portion of the reactor apparatus
16 comprising:

17 a containment portion that in combination with the substrate encloses a
18 fluidic channel;

19 a portion of at least one heating element that is applied to at least a portion
20 of the fluidic channel;

21 wherein the containment portion are formed in the polymer layer as a
22 unitary structure; and

1 wherein certain portions of the containment portion are fabricated using a
2 strong exposure process, while other portions of the containment portion are
3 fabricated using a weak exposure cross-linking process.

4 **49.** (Withdrawn) A method of making a separator on a substrate, comprising:
5 depositing a polymer material on the substrate to form a polymer layer;
6 forming a controllable electric potential source relative to the polymer
7 layer; and

8 hardening portions of the polymer layer to create a containment portion,
9 wherein the containment portion is formed as a unitary structure.

10 **50.** (Withdrawn) The method of claim 49, further comprising spinning the
11 deposited polymer material to make the polymer layer more planar.

12 **51.** (Withdrawn) The method of claim 49, wherein the separator utilizes
13 electrophoresis to separate particles.

14 **52.** (Withdrawn) The method of claim 49, wherein certain portions of the
15 containment portion are fabricated using a strong exposure process, while other
16 portions of the containment portion are fabricated using a weak exposure cross-
17 linking process.

18 **53.** (Withdrawn) A separator apparatus formed including a polymer layer and a
19 substrate portion, the polymer layer of the separator apparatus comprising:
20 a containment portion that in combination with the substrate encloses a
21 fluidic channel, wherein the containment portion is formed in the polymer layer as
22 a unitary structure.

1 **54.** (Withdrawn) A method of making a filter including a plurality of filter
elements on a substrate, comprising:

2 depositing a polymer material on the substrate to form a polymer layer; and
3 hardening portions of the polymer layer to create the plurality of filter
4 elements and a containment portion from the polymer layer, wherein the plurality
5 of filter elements and the containment portion are formed as a unitary structure.

6 **55.** (Withdrawn) The method of claim 54, further comprising spinning the
7 deposited polymer material to make the polymer layer more planar.

9 **56.** (Withdrawn) The method of claim 54, wherein the plurality of filter
10 elements are created using a strong exposure cross-linking process.

12 **57.** (Withdrawn) The method of claim 54, wherein certain portions of the
13 containment portion are fabricated using a strong exposure process, while other
14 portions of the containment portion are fabricated using a weak exposure cross-
15 linking process.

16 **58.** (Withdrawn) A filter apparatus formed including a polymer layer and a
17 substrate portion, the polymer layer of the filter apparatus comprising:

18 a plurality of filter elements including a deep cross-linked polymer region;
19 a containment portion that in combination with the substrate encloses a
20 fluidic channel; and

21 wherein the plurality of filter elements and the containment portion are
22 formed in the polymer layer as a unitary structure.

1 **59.** (Withdrawn) A method of making an optical waveguide on a substrate,
2 comprising:
3 depositing a polymer material on the substrate to form a polymer layer; and
4 hardening portions of the polymer layer to create an input optical conduit, a
5 focusing lens, and a containment portion from the polymer layer, wherein the
6 input optical conduit, the focusing lens, and the containment portion are formed as
7 a unitary structure.

8 **60.** (Withdrawn) The method of claim 59, further comprising spinning the
9 deposited polymer material to make the polymer layer more planar.

10
11 **61.** (Withdrawn) The method of claim 59, wherein the input optical conduit
12 and the focusing lens are at least partially created using a strong exposure cross-
13 linking process.

14
15 **62.** (Withdrawn) The method of claim 59, wherein certain portions of the
16 containment portion are fabricated using a strong exposure process, while other
17 portions of the containment portion are fabricated using a weak exposure cross-
18 linking process.

19
20 **63.** (Withdrawn) A waveguide apparatus formed including a polymer layer and
21 a substrate portion, the polymer layer of the waveguide apparatus comprising:
22 an input optical conduit including a deep cross-linked polymer region;
23 a focusing lens including a deep cross-linked polymer region;
24 a containment portion that in combination with the substrate encloses a
25 fluidic channel; and

1 wherein the input optical conduit, the focusing lens, and the containment
portion are formed in the polymer layer as a unitary structure.

2

3 **64.** (Withdrawn) A method comprising:

4 depositing a structural material layer that defines the lateral boundaries of at
5 least one fluidic channel of a fluidic micro electromechanical system (MEMS)
6 device; and

7 laminating a dry film layer on the deposited structural material to at least
8 partially define an upper layer that of the at least one fluid channel.

9

10 **65.** (Withdrawn) A method comprising:

11 depositing a sacrificial material on a substrate;

12 depositing a polymer layer on the substrate and the sacrificial material; and

13 removing the sacrificial material to at least partially define boundaries of at
14 least one fluidic channel of a fluidic micro electromechanical system (MEM)
15 device, the at least one fluidic channel is at least partially defined by a portion of
16 the polymer layer and a portion of the substrate.

17

18 **66.** (Withdrawn) An anchor apparatus, comprising:

19 a deep cross-linked polymer region;

20 a shallow cross-linked polymer region supported by the deep cross-linked
21 polymer region, the shallow cross-linked polymer region having a thru-hole
22 formed therein, wherein the deep cross-linked polymer region and the shallow
23 cross-linked polymer region are attached; and

24 a connector portion that secures to the thru-hole, wherein the top-hat
25 structure enhances the attachment of the connector to the thru-hole.

1 **67.** (Withdrawn) The anchor apparatus of claim 66, further comprising glue to
2 secure the connector portion to the thru-hole.

3 **68.** (Withdrawn) The anchor apparatus of claim 67, wherein the shallow cross-
4 linked polymer region forms an overhang portion, wherein the glue is affixed to
5 the overhang portion in a manner to enhance the attachment of the connector to the
6 thru-hole.

7 **69.** (Withdrawn) The anchor apparatus of claim 66, further comprising epoxy
8 to secure the connector portion to the thru-hole.

9 **70.** (Withdrawn) The anchor apparatus of claim 66, wherein the deep cross-
10 linked polymer region and the shallow cross-linked polymer region form a top-hat
11 structure.